TWI

35-130
45-190

Installation User and Service Manual

A.O. SMITH
WATER PRODUCTS COMPANY
A DIVISION OF A. O. SMITH CORPORATION

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Carefully read this manual

Warning
Carefully read this manual before starting up the device.
Not reading this manual and not following the instructions in this manual may lead to personal injuries and damage to the device.

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Although utmost care has been taken in ensuring a correct and, where necessary, complete description of the relevant parts, the manual may contain faults and obscurities.

Should you still discover faults or obscurities, please inform us about this. It helps us to further improve the documentation.

Additional information

If you have any remarks or questions concerning specific subjects related to the device, please do not hesitate to contact. A.O. Smith Water Products Company
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For problems with respect to connections to gas, electricity and water supplies, please contact the supplier/installation engineer of your installation.

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1 Introduction

1.1 About the device

This manual describes the installation, service and use of the TWI-device.
The TWI-device is a condensating boiler with a fan in the air supply. The TWI can be installed both as a closed and as an open device. The device typically has a concentric chimney connection. The device can also be connected as a parallel system.
The possible device types are B23, C13, C33, C43, C53 and C63.
The information in this manual is applicable to the TWI 35-130 and TWI 45-190.
The construction method and the equipment of the device are in conformity with the European standard for gas-fired storage water heaters for the production of domestic hot water (EN 89). With this the devices comply with the European Directive for Gas Devices and so they have the right to the CE -mark.

CE
0063

Warning
Carefully read this manual before starting up the boiler. Not reading this manual and not following the given instructions may lead to personal injuries and damage to the device.

1.2 What to do when you smell gas

Warning
In case of smelling gas:

No open fire! No smoking!

Avoid sparking!
Do not use any electric switches, including telephone, plug or bell!

Open windows and doors!

Shut off the mains gas supply valve!

Warn occupants and leave the building!

After having left the building, warn the gas company or the installation engineer.

1.3 Regulations

As (end) user, installation engineer or service and maintenance engineer you shall make sure that the entire installation at least complies with the locally applicable:

- building regulations;
- guidelines for existing gas systems formulated by the electricity company;
- guidelines for natural gas systems and the corresponding practical guidelines;
- safety regulations for low-voltage systems;
- regulations concerning drinking water supply;
- regulations concerning ventilation in buildings;
- regulations concerning supply of combustion air;
- regulations concerning discharge of flue gasses;
- requirements for gas-consuming systems;
- regulations concerning inside sewer systems in buildings;
- regulations of the fire department, electricity companies and the municipality.

Further the installation shall comply with the regulations of the manufacturer.

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Remark
Supplements or later adjustments and/or additions to any regulations, requirements and guidelines are applicable at the moment of installing.

1.4 Target groups

The three target groups for this manual are:
- (end) users;
- installation engineers;
- service and maintenance engineers.

Symbols indicate on every page for which target group the information is intended. See the table.

Symbols per target group

Symbol	Target group
	(End) user
	Installation engineer
	Service and maintenance engineer

1.5 Maintenance

Service shall be carried out at least once a year both on the gas side and on the water side. The frequency of the maintenance depends, among other things, on the water quality, the average number of operating hours per day and the set water temperature.

Remark
For determining the correct maintenance frequency, it is advised to have the service and maintenance engineer check the gas side and the water side of the device three months after installation. The maintenance frequency can be determined on the basis of this check.

Remark
Regular maintenance lengthens the life of the device.
Both the end user and the service and maintenance engineer are responsible for regular maintenance. They shall make clear appointments about this.

Remark
If the device is not regularly maintained, the warranty will become null and void.

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1.6 Notation system

This manual makes use of the following notation system:

Remark
Attention: important notice.

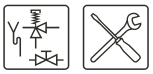
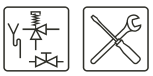
Caution
Ignoring this text may result in damage of the device.

Warning
Ignoring this text may lead to serious damage of the device and to situations that are dangerous to people.

1.7 Overview of this document

The table provides an overview of the content of this document.

Content of this document

Chapter	Target groups	Description
2. Operation of the device		This chapter describes the operation of the device.
3. Installation		This chapter describes the installation activities to be carried out before definitely starting up the device.
4. Conversion to another category		Conversion to another category is not possible.
5. Fill		This chapter describes how to fill the device.
6. Drain		This chapter describes how to drain the device.
7. Start up		This chapter describes how to start up the device. It further describes the general heating cycle of the device.
8. Shut down		This chapter describes how to shut down the device for a shorter or longer period.
9. Errors		This chapter is mainly meant for the installation engineer and the service and maintenance engineer. It describes the errors of the device. These errors are shown on the display. A table gives the possible cause and solution. However, an end user can also find additional information about the device here.
10. Maintenance		This chapter describes how to determine the frequency for maintenance activities. Both the end user and the service and maintenance engineer are responsible for regular maintenance. They shall make clear appointments about this. Remark If the device is not regularly maintained, the warranty will become null and void.

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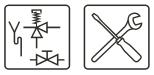
1 Introduction

Chapter	Target groups	Description
11. Warranty (certificate)		This chapter contains the terms of warranty.
12. Annexes		This chapter contains the electrical circuit diagram.

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2 Operation of the device

2.1 Introduction

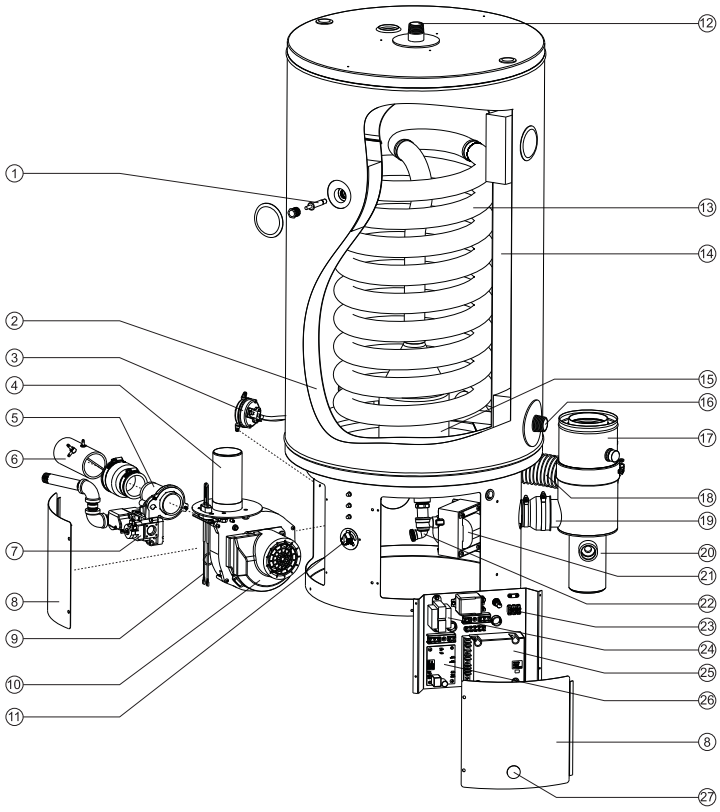
This chapter will cover in the given order:
- General operation of the device;
- Heating cycle of the device;
- Security of the device;
- Safety of the installation.

2.2 General operation of the device

The figure shows a cross section of the device.

Cross section of the device

Legends IMD-0527
1. Temperature sensor / ECO
2. Insulating layer
3. Air pressure switch
4. Burner
5. Venturi
6. Air supply pipe
7. Gas control
8. Cover plate
9. Hot surface igniter
10. Fan
11. Thermostat
12. Hot water outlet
13. Heat exchanger
14. Tank
15. Combustion chamber
16. Cold water inlet
17. Concentric measuring tube
18. Air supply hose
19. Flue gas discharge
20. Siphon
21. Transformer 230 VAC-120 VAC
22. Drain valve
23. Connector
24. Transformer 120 VAC-24 VAC
25. Electronic control
26. Thermostat board
27. Inspection window



IMD-0527 RO

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In this device the cold water is supplied through the cold water inlet (16) at the bottom of the tank. The tap water heated by the combustion chamber (15) and heat exchanger (13) leaves the tank at the hot water outlet (12). If the device is maximally filled with water, there is a constant water piping pressure. When tapping hot water from the device, cold water is immediately added again.

The device has been provided with an e premix burner (4) with 1:1 gas/air ratio control. The fan (10) sucks in the air that is required for the combustion. The gas is supplied through the gas control (7) and the venturi on the suction side of the fan. The 1:1 gas/air coupling always ensures an optimum gas/air ratio.

Because of the special construction of the heat exchanger (13), the flue gasses are first led up through the combustion chamber and then down through the heat exchanger along the water. This gradually cools down the flue gasses. As the cooled down flue gasses are finally led along the cold water at the bottom of the tank as well, the flue gasses start condensating. Condensation causes release of energy (heat) that is also transferred to the water, which improves the output. The condensate that is formed with this heating is discharged through the siphon (20). The insulating layer (2) prevents loss of heat.

2.3 Heating cycle of the device

The temperature sensor (1) measures the water temperature. As soon as the measured temperature is below the set water temperature, the electronic control observes a ‘heat demand’. The gas control (7) opens after about half a minute and the gas mixes with the air. The hot surface igniter (9) ignites this mixture and the water is heated. As soon as the measured temperature is above the set water temperature, the heat demand ends and the electronic control stops the heating cycle.

2.4 Security of the device

2.4.1 Introduction

The electronic control monitors the water temperature and ensures safe combustion. This is done by:
- the Security of the water temperature;
- the Gas control;
- the Fan;
- the Air pressure switch;
- the Ionisation detection.

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2.4.2 Security of the water temperature

The safety switch or ECO (Energy Cut-Off) switches off the device when the water temperature exceeds 95 ºC. As soon as the temperature has sufficiently dropped, the ECO is reset automatically. Contact the installation engineer if the ECO repeatedly switches off the device.

2.4.3 Gas control

The electronic control opens the gas control allowing supply of gas to the burner. The gas control has two valves as a safety device. Both valves shut off the gas supply.

2.4.4 Fan

The fan (10) ensures optimum air supply during the heat demand. In view of safety, the fan makes sure that the combustion chamber is purged before ignition takes place. This is called pre-purging.

2.4.5 Air pressure switch

The air pressure switch guarantees discharge of flue gasses and supply of air during pre-purging and operation of the device. The air pressure switch is typically open. When the pressure difference is sufficient, the pressure switch closes. If, however, a disturbance occurs, the pressure switch opens again and the heating cycle is interrupted. The table gives the trip points for each device.

Remark
The trip point of the pressure switch cannot be adjusted.

Trip point of the pressure switch

Device	Pressure difference
TWI 35-130	700 Pa
TWI 45-190	370 Pa

2.4.6 Ionisation detection

The electronic control uses the hot surface igniter for flame detection by means of ionisation detection. The electronic control closes the gas valve as soon as it observes that there is no flame while gas is flowing.

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2.5 Safety of the installation

Apart from the standard security of the device, the installation shall further be protected using an expansion vessel, an expansion valve, a pressure reducing valve, a non-return valve and a T&P valve.
The use of an expansion vessel, expansion valve and/or pressure reducing valve is dependent on the type of installation: unvented or vented.

2.5.1 Unvented installation

With an unvented installation an expansion valve and an expansion vessel avoid a too high pressure in the tank. This prevents damage to the tank.
A non-return valve avoids a too high pressure on the water piping. This valve also avoids water from the tank flowing into the water piping. The pressure reducing valve protects the installation against a too high water piping pressure (> 8 bars). The parts are mounted into the cold water system (3.6.1 “Cold water side”).

2.5.2 Vented installation

With a vented installation the open water tank absorbs the overpressure. The height of the water tank determines the maximum operating pressure in the tank. The maximum operating pressure is 8 bars. The installation shall also be equipped with an expansion valve of the hot water piping that flows out into the water tank. In the ideal situation this should flow out in a separate discharge channel, otherwise in the open water tank. The device shall also have a stop valve on the water side (3.6.2 “Hot water side”).

2.5.3 T&P valve

A T&P valve is only obligatory with unvented installations. However, A.O. Smith recommends using a T&P valve with vented installations as well. A T&P valve (Temperature & Pressure valve) monitors the pressure in the tank and the water temperature at the upper part of the tank. The valve will open when the pressure in the tank becomes too high (> 10 bars) or when the water temperature gets too high (> 97°C). The hot water can now flow out of the tank. As the device is under water piping pressure, cold water will automatically flow into the tank. The valve remains open until the unsafe situation has been removed. The device typically has a connecting point for a T&P valve (3.6.2 “Hot water side”).

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3 Installation

Warning
The installation shall be carried out by an authorised installation engineer in accordance with the generally and locally applicable regulations of gas, water, electricity companies and the fire brigade.
The device shall only be installed in an area that amply meets the national and local ventilation regulations (1.3 “Regulations”).

3.1 Introduction

This chapter describes the installation activities to be carried out before definitely starting up the device (7 “Start up”), being:

- Packaging;
- Ambient conditions;
- Technical specifications;
- Connections diagram;
- Water connections;
- Gas connection;
- Air supply and flue gas discharge;
- Electrical connection;
- Check and adjust the CO_2-value

3.2 Packaging

Carefully remove the packaging in order to prevent damaging the device.
You can best unpack the device when it is close to or on its definite place.

Caution
Move the device only standing up. Make sure not to damage the device after unpacking.

3.3 Ambient conditions

The device is suitable for both closed and open combustion. If installed as a closed device, it is independent of the installation area for the required air supply. Therefore there are no additional ventilation regulations.
If the device is installed as an open device, it should meet the local guidelines and ventilation regulations for open devices.

The possible device types are B23, C13, C33, C43, C53 and C63.

Caution
In view of a risk of explosion and corrosion of the device, do not use the device in areas where chemical substances are stored or used. Some propellants, bleaching agents, degreasants and the like spread explosive vapours and/or corrosion-accelerating vapours. Use of the device in an area where such substances are present makes the warranty null and void.

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3.3.1 Air humidity and ambient temperature

The installation area should be frost-free or be protected against frost. The table gives the ambient conditions that shall be observed in order to be able to ensure the functioning of the applied electronics.

Specifications for air humidity and ambient temperature

Air humidity and ambient temperature	
Air humidity	max. 93% RH at +25°C
Ambient temperature	Functional: 0 ≤ t ≤ 60°C

3.3.2 Maximum floor loading

In view of the weight of the device, take the maximum floor loading into account. See the table below.

Specification for weight in connection with the maximum floor loading

Weight of the device filled with water	
TWI 35-130	199 kg
TWI 45-190	271 kg

3.3.3 Water composition

The device is designed for heating drinking water. The drinking water shall comply with the regulations for drinking water for human consumption. The table gives an overview of the specifications.

Specifications for water

Water composition	
Hardness (alkaline earth ions)	> 1.00 mmol/l: - German hardness > 5.6° dH - French hardness > 10.0° fH - British hardness > 7.0° eH
Conductivity	> 125 muS/cm
Acidity (pH-value)	7.0 < pH-value < 9.5

Remark
When the specifications mentioned in the table are deviated from, the protection of the tank can not be guaranteed (11 “Warranty (certificate)”).

3.3.4 Working area

In view of the accessibility of the device, it is recommended to apply the following distances (see figure):

- AA: on the front side of the device: 100 cm.
- BB: around the device: 50 cm.
- Top side of the device: 50 cm.

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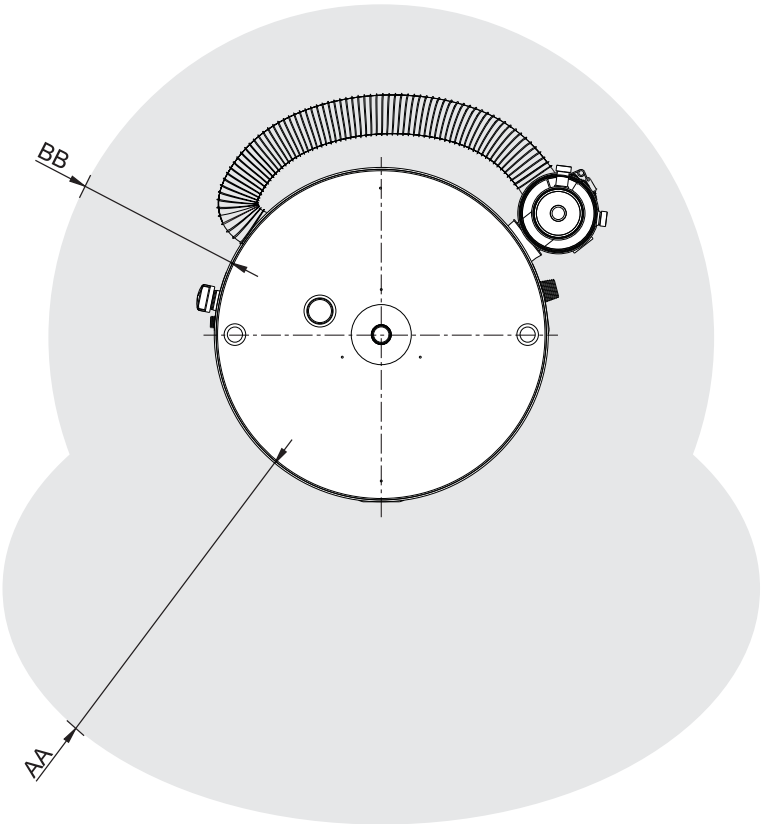
Remark

When installing the device, make sure that the device cannot damage the immediate surroundings or lower floors in case of leakage of the tank and/or connections. If this is the case, install the device near a floor discharge or in a metal drip tray of the right size.

A drip tray shall have a solid discharge and be at least 5 cm deep with a length and width of at least 5 cm larger that the diameter of the device.

Working area



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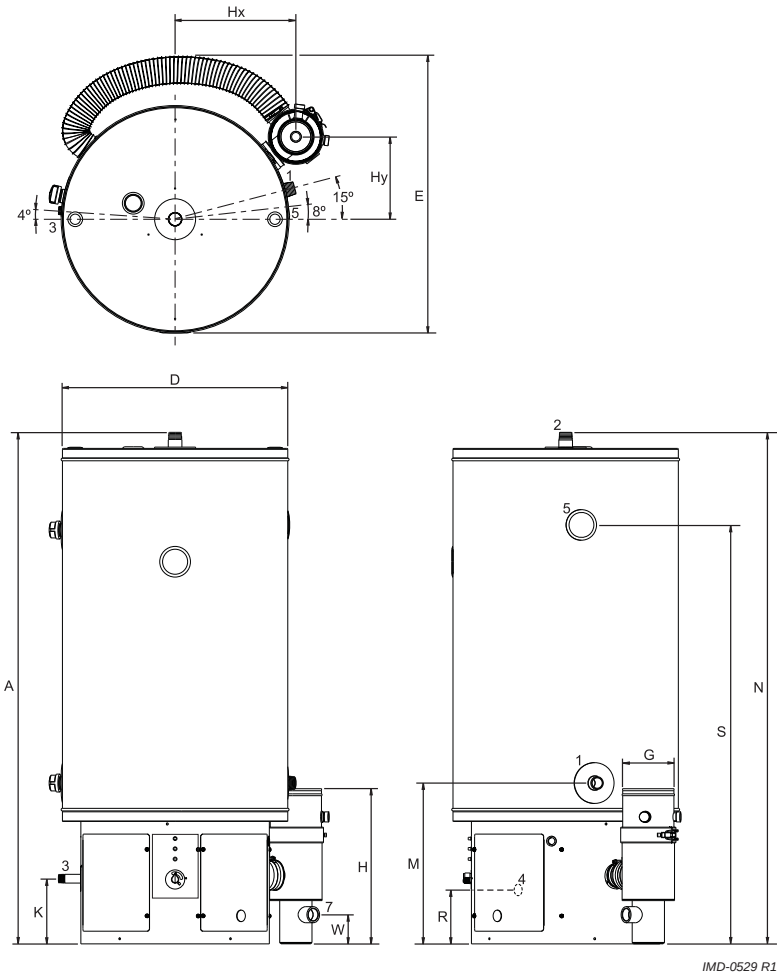
3.4 Technical specifications

The tables below contain the technical data.

3.4.1 Dimensions of the device

Top and bottom views of the device

Legends
See the table.



Dimensions (all sizes in mm, unless stated otherwise)

Dimension	Description	TWI 35-130	TWI 45-190
A	Overall height	1270	1620
D	Device diameter	560	560
E	Depth	730	730
G	Diameter flue gas discharge/air supply	80/125	80/125
H	Height flue gas discharge/air supply	385	385
Hx	x-position flue gas discharge	300	300
Hy	y-position flue gas discharge	205	205
K	Height gas/burner connection	160	160
M	Height cold water supply	400	400
N	Height hot water outlet	1270	1620

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Dimension	Description	TWI 35-130	TWI 45-190
R	Height drain valve connection	155	155
S	Height T&P valve connection	1040	1395
W	Height condensation drainage	100	100
1	Cold water supply connection	1” NPT	1” NPT
2	Hot water outlet connection	1” NPT	1” NPT
3	Gas control/burner connection	1/2” NPT	3/4” NPT
4	Drain valve connection	3/4” NPT	3/4” NPT
5	T&P valve connection	1” NPT	1” NPT
7	Condensation drainage connection	Rp 1	Rp 1

3.4.2 General and electrical data

General and electrical data

Description	Unit	TWI 35-130	TWI 45-190
Volume	l	129	189
Empty weight	kg	70	82
Maximum operating pressure	bar	8	8
Fan speed at ignition	rpm	0	0
Operating speed of fan	rpm	7100	8750
Heating time ΔT = 45°C	min.	11	13
Electrical power consumption	Watt (W)	200	300
Supply voltage (-15% +10% VAC)	Volt (V)	230	230
Mains frequency	Hz	50	50
IP-class	-	30	30

3.4.3 Gas data

Gas data

Description I2H	Unit	TWI 35-130	TWI 45-190
Gas category 2H: G20 – 20 mbar			
Nominal load (Upper value)	kW	37,8	50,0
Nominal output	kW	35,8	47,3
Supply pressure	mbars	20	20
Gas consumption (*)	m³/h	3,6	4,8
CO_2	Vol%	9,0 ± 0,5	9,3 ± 0,5
(*) Based on 1013,15 mbar and 15°C.			

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3.5 Connections diagram

The figure shows the connections diagram. This diagram is used in the sections describing the actual connecting activities.

Connections diagram

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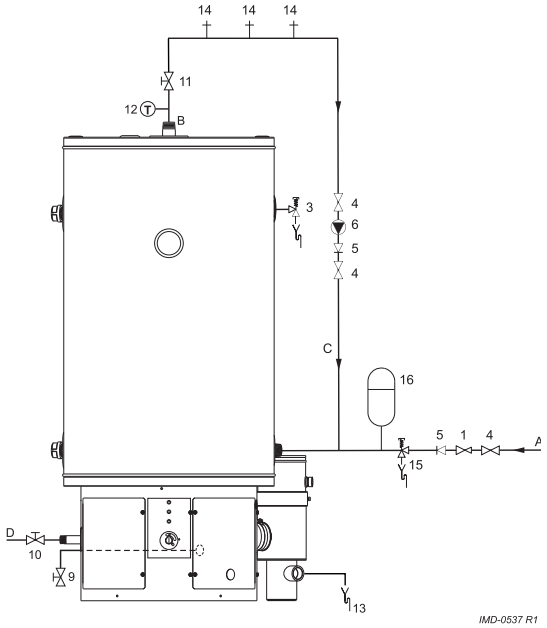
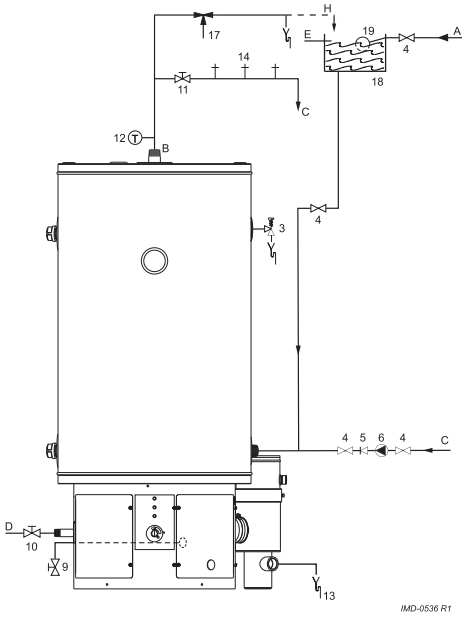


VENTED



Legends
Not mentioned numbers are not applicable.

1. pressure reducing valve (obligatory)
3. T&P valve (obligatory)
4. stop valve (recommended in pipe C and obligatory in pipe A)
5. non-return valve (obligatory)
6. circulation pump (optional)
9. drain valve
10. manual gas valve (obligatory)
11. service valve
12. temperature meter (optional)
13. condensation drainage
14. draw-off points
15. expansion valve (obligatory)
16. expansion vessel (obligatory)
17. three-way aeration valve (recommended)
18. water tank
19. float valve

A. cold water supply
B. hot water discharge
C. circulation piping
D. gas supply
E. water overflow
H. overflow pipe

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3.6 Water connections unvented

Warning
The installation shall be carried out by a recognised installation engineer in accordance with the generally and locally applicable regulations (1.3 “Regulations”).

3.6.1 Cold water side

See (A) in the connections diagram (3.5 “Connections diagram”).

1. Position an approved stop valve (4) on the cold water side in accordance with the applicable regulations (1.3 “Regulations”).
2. The maximum operating pressure of the device is 8 bars. As the water piping pressure can incidentally exceed 8 bars, mount an approved pressure reducing valve (1).
3. Mount a non-return valve (5) and an expansion vessel (16).
4. Mount an expansion valve (15) and connect the overflow side to an open water drainage pipe.

3.6.2 Hot water side

See (B) in the connections diagram (3.5 “Connections diagram”).

Note
Insulation of the long hot water pipes prevents unnecessary loss of energy.

1. Option: mount a temperature meter (12) for checking the temperature of the tap water.
2. Mount the T&P valve (3).
3. Mount a stop valve (11) in the hot water distribution piping for service purposes.

3.6.3 Circulation piping

See (C) in the connections diagram (3.5 “Connections diagram”). If you want to have hot water available immediately, you can install a circulation pump at the draw-off points. This is more comfortable and avoids spillage of water.

1. Mount a circulation pump (6) wit a capacity that corresponds with the size and the resistance of the circulation system.
2. Mount a non-return valve (5) following the circulation pump to guarantee the circulation direction.
3. Mount two stop valves (4) for service purposes.
4. Connect the circulation piping to the cold water supply pipe.

3.6.4 Condensation drainage

1. Attach underneath the fall a drainage pipe to the siphon (13) for condensation drainage and connect this to the water discharge pipe.

Attention
All connections downstream the siphon shall be condensation-resistant.

3.7 Water connections vented

Warning
The installation shall be carried out by a recognised installation engineer in accordance with the generally and locally applicable regulations (1.3 “Regulations”).

3.7.1 Cold water side

See (A) in the connections diagram (3.5 “Connections diagram”).

1. Mount on the cold water side an approved stop valve (4) between the water tank (18) and the device in accordance with the applicable regulations (1.3 “Regulations”).

3.7.2 Hot water side

See (B) in the connections diagram (3.5 “Connections diagram”).

Note
Insulation of the long hot water pipes prevents unnecessary loss of energy.

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1. Mount the T&P valve (3).
2. Option: mount a temperature meter (12) for checking the temperature of the tap water.
3. Mount a stop valve (4) in the hot water distribution piping for service purposes.
4. If circulation piping is required, proceed by mounting the circulation piping (3.6.3 “Circulation piping”).

3.7.3 Circulation piping

See (C) in the connections diagram (3.5 “Connections diagram”).
If you want to have hot water available immediately, you can install a circulation pump at the draw-off points. This is more comfortable and avoids spillage of water.

1. Mount a circulation pump (6) wit a capacity that corresponds with the size and the resistance of the circulation system.
2. Mount a non-return valve (5) following the circulation pump to guarantee the circulation direction.
3. Mount two stop valves (4) for service purposes.
4. Connect the circulation piping to the cold water supply pipe.

3.7.4 Condensation drainage

1. Attach underneath the fall a drainage pipe to the siphon (13) for condensation drainage and connect this to the water discharge pipe.

Attention
All connections downstream the siphon shall be condensation-resistant.

3.8 Gas connection

Warning
The installation shall be carried out by a recognised installation engineer in accordance with the generally and locally applicable regulations (1.3 “Regulations”).

Caution
Make sure that the diameter and the length of the gas supply pipes are suitable for delivering sufficient capacity to the device.

See (D) in the connections diagram (3.5 “Connections diagram”).

1. Mount the gas valve (10) in the gas supply pipe.
2. Purge the gas pipe before use.
3. Close the gas valve.

Warning
Check for leakages after mounting.

3.9 Air supply and flue gas discharge

3.9.1 Introduction

This section describes the following subjects:

- Requirements for flue gas discharge material
- Parallel connections

3.9.2 Requirements for flue gas discharge material

Warning
The installation shall be carried out by a recognised installation engineer in accordance with the generally and locally applicable regulations (1.3 “Regulations”).

There are various possibilities for connecting the air supply and flue gas discharge, dependent on the inspected device types.

The devices have been inspected for the device types B23, C13, C33, C43, C53 and C63.

The figure and the table provide information about these device types. Please contact the manufacturer if you require an explanation of the possibilities.

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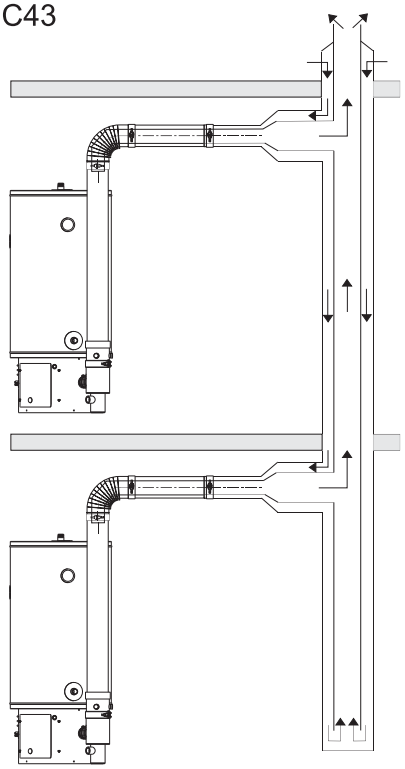
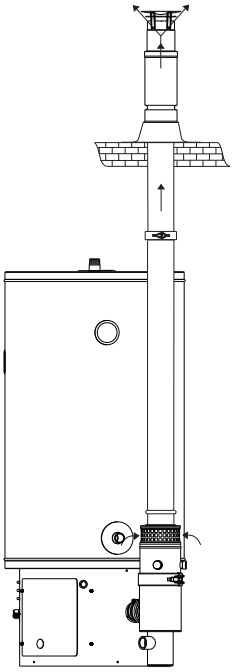
Device types

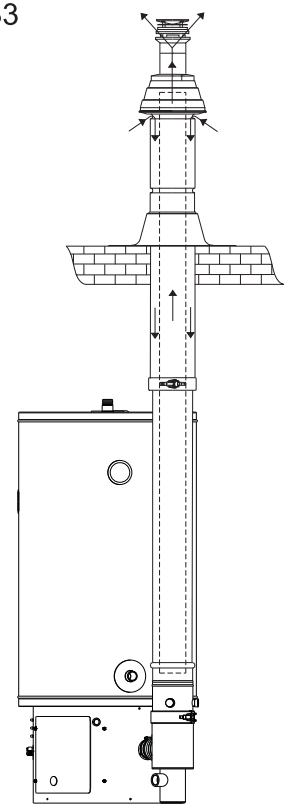
C43



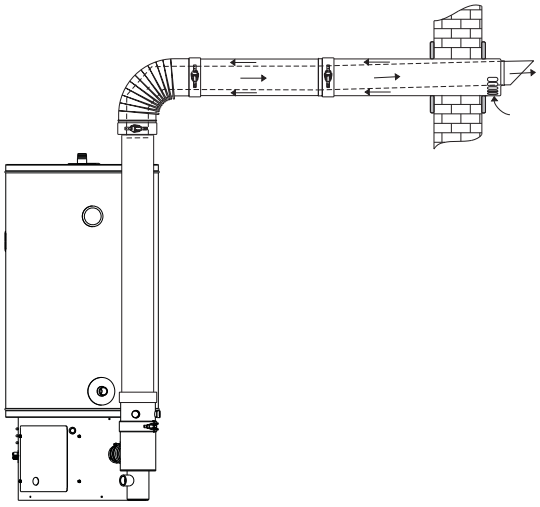
B23



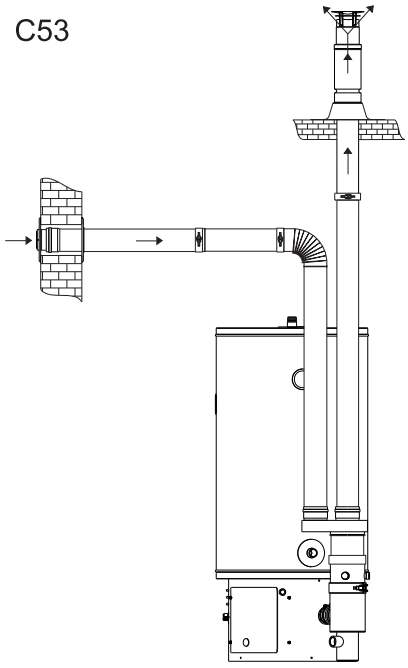
C33



C13



C53



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Explanation of device types

Device types	Description
B23	Combustion air is extracted from the installation area.
C13	Concentric and/or parallel wall flue terminal
C33	Concentric and/or parallel roof flue terminal
C43	Devices on common supply and discharge (concentric and/or parallel) in blocks of flats.
C53	Supply and discharge in different pressure area.
C63	Devices delivered without flue gas discharge materials and/or terminal. These devices are to be installed in accordance with the applicable local guidelines.

Remark
Make sure that the flue gas discharge is positioned in a discharge area in which discharge is allowed for the respective device type.

3.9.3 Concentric connections

The table gives the requirements that the concentric systems shall meet.

Warning
Mount flue gas discharge material with a fall of 5 mm per metre towards the device.

Requirements for flue gas discharge for concentric systems (C13, C33)

Device	Diameter	Maximum length	Maximum number of 90° bends
TWI 35-130	80/125	20	5
TWI 45-190	80/125	20	5

Caution
Both conditions given in the table shall be complied with.
When using less than the maximum number of bends, it is still not allowed to use more than the maximum pipe length.

When using less than the maximum pipe length, it is still not allowed to use more than the maximum number of bends.

All this will be explained using an example.

Practical example of concentric flue gas discharge

Example
The figure shows a TWI 35-130. The device shall be provided with a 15 m concentric pipe (C13/C33) and four 90° bends. An inspection shall be carried out for compliance of this configuration with the requirements stated in the table.

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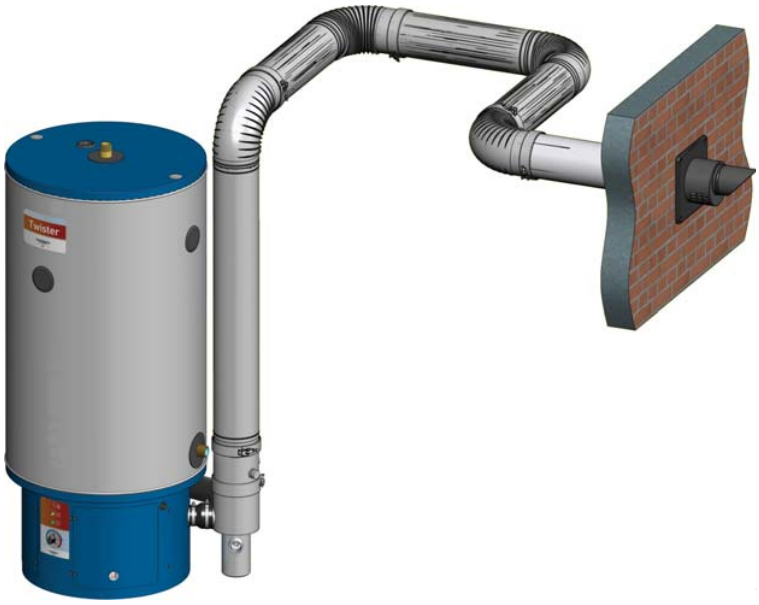
Device with concentric flue gas discharge material



According to the table the maximum length is 20 metres and the allowed number of 90° bends is 5. Both requirements are met.

Specifications

Caution
A.O. Smith prescribes the use of a roof or wall flue terminal approved for the device with the C13 and C33 device types. Use of an improper roof or wall flue terminal may lead to an error.

Specification of concentric wall flue terminal C13

Subject		**Description**
Wall flue terminal set:- 1x Wall flue terminal (incl. wall plate & clamping strip) - 1x Pipe 500 mm - 1x Bend 90°	Item no.:	TWI 35-130: 0302 515 (1) TWI 45-190: 0302 515 (1)
	Construction:	Concentric
	Manufacturer:	Muelink & Grol
	Type:	M2000 MDV SEC
Piping material	Construction:	Concentrique
	Flue gas discharge:	Thick-walled aluminium with lip-ring sealing
	Air supply:	Thin-wall galvanised sheet steel
Pipe diameters	Flue gas discharge:	TWI 35-130: Ø 80 mm TWI 45-190: Ø 80 mm
	Air supply:	TWI 35-130: Ø 125 mm TWI 45-190: Ø 125 mm
(1) It is not allowed to use any other wall flue terminal. You can order the wall flue terminal mentioning the item number with A.O. Smith, manufacturer or wholesaler's.		

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Specification of concentric roof flue terminal C33

Subject		Description
Roof flue terminal set:- 1x Roof flue terminal (incl. clamping strip) - 1x Pipe 1000 mm - 1x Mounting flange	Item no.:	TWI 35-130: 0305 042 (1) TWI 45-190: 0305 042 (1)
	Construction:	Concentrique
	Manufacturer:	Muelink & Grol
	Type :	M2000 DDV HR-C
Piping material	Construction :	Concentrique
	Flue gas discharge:	Thick-walled aluminium with lip-ring sealing
	Air supply:	Thin-wall galvanised sheet steel
Pipe diameters	Flue gas discharge:	TWI 35-130: Ø 80 mm TWI 45-190: Ø 80 mm
	Air supply:	TWI 35-130: Ø 125 mm TWI 45-190:Ø 125 mm
(1) It is not allowed to use any other roof flue terminal. You can order the roof flue terminal mentioning the item number with A.O. Smith, manufacturer or wholesaler's.		

3.9.4 Parallel connections

The table gives the maximum pipe length for parallel systems. The maximum pipe length depends on the selected diameter.

Warning
Mount flue gas discharge material with a fall of 5 mm per metre towards the device.

Requirements for flue gas discharge for parallel systems

Device	Diameter (1)	Maximum running length	$L_{equivalent}$ 90° bend	$L_{equivalent}$ 45° bend
TWI 35-130	80	30	3,9	1,1
TWI 45-190	80	20	3,9	1,1
TWI 35-130	100	100	4,6	1,2
TWI 45-190	100	75	4,6	1,2
(1) The given larger diameter can be used if the maximum running length is insufficient. When using a larger diameter, this shall be used for both the air supply and the flue gas discharge.				

Use the longest pipe for calculating the pipe length. If, for example, the flue gas discharge pipe is 10 metres and the air supply pipe is 15 metres, use the 15 metres for calculating the length. Then add the Lequivalent to these 15 metres for each 90° and 45° bend in both the air supply and the flue gas discharge. All this will be explained using a practical example.

Practical example of parallel flue gas discharge

Example
The figure shows a TWI 35-130. The device is to be provided with a 25 m parallel pipe with a diameter of 100 mm and eight 90° bends. An inspection shall be carried out for compliance of the configuration with the requirements stated in the table.

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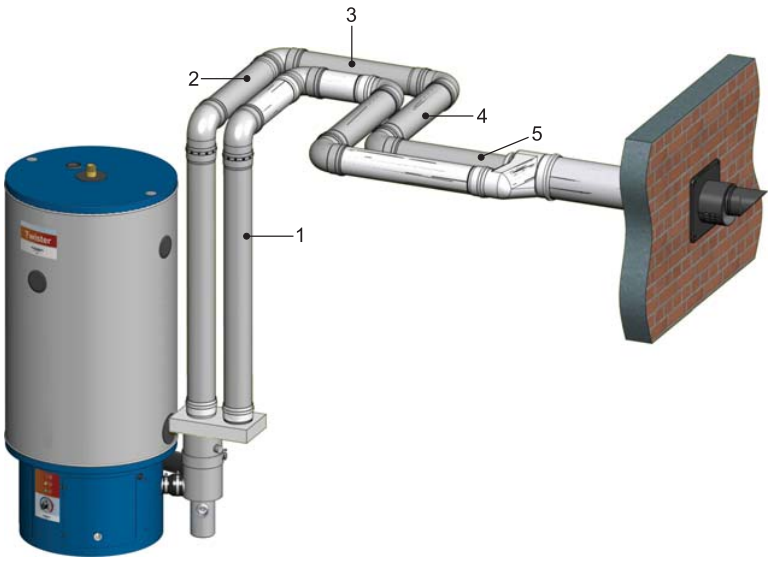
Device with parallel flue gas discharge material



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Use the longest pipe to test for the maximum length. In this case this is the flue gas discharge pipe, that has a length of 25 metres. These 25 metres are composed of the pipe material parts 1, 2, 3, 4 and 5. The length of the transition piece need not be taken into account. The total number of used bends, in the flue gas discharge and air supply, is eight. The bend in the transition piece need not be taken into account. According to the table, 4.6 metres shall be calculated for each bend. This makes the total pipe length:
(4.6 x 8) + 25 = 36.8 + 25 = 61.8 m.
This is shorter than the length of 100 metres given in the table. Therefore the installation meets the requirements.

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3.10 Electrical connection

Warning
The installation shall be carried out by a recognised installation engineer in accordance with the generally and locally applicable regulations (1.3 “Regulations”).

3.10.1 Introduction

This section will cover in the given order:
• Preparation;
• Connect the mains voltage;
• Isolating transformer.

Remark
The optional components have not been included in the electrical power consumption indicated in the table (3.4.2 “General and electrical data”).

3.10.2 Preparation

Caution
The device is phase-sensitive. It is absolutely necessary to connect the phase (L) of the mains to the phase of the device and to connect the zero (Z) of the mains to the zero of the device.

Caution
No voltage difference is allowed between the zero (Z) and the earth (⏚).
If this is the case, apply an isolating transformer (3.10.4 “Isolating transformer”).

Please contact A.O. Smith for additional information or for ordering this isolating transformer. The figure shows a view of the electrical connector block.

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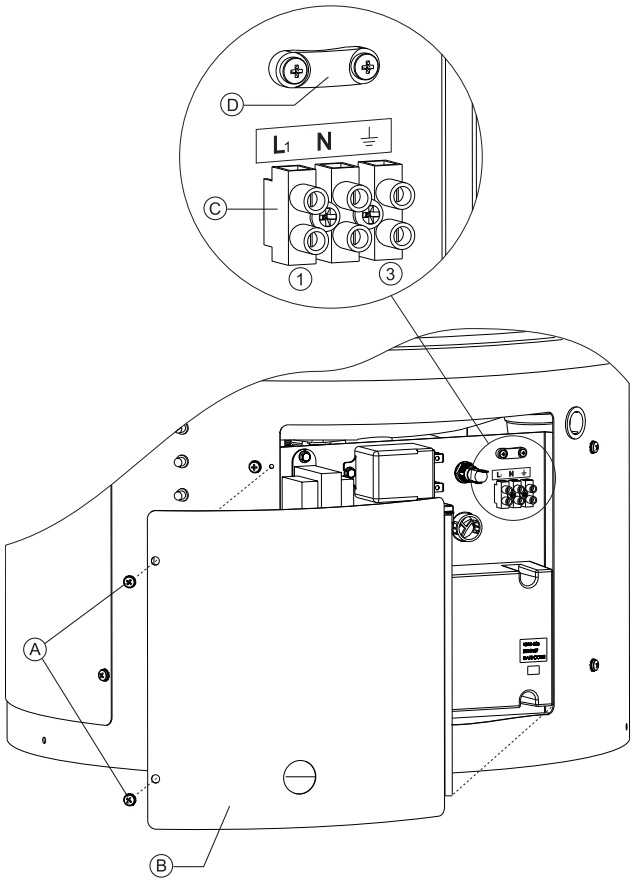
Connector block



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Legends
A. screws
B. cover plate
C. connector block
D. strain relief

For preparation remove the cover plate (B) from the electricity part by loosening the two screws (A).

Remark
Consult the electrical circuit diagram for connecting the electrical components.

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3.10.3 Connect the mains voltage

The device is delivered without power cable and main switch.

Remark
In order to supply voltage to the device, connect the device to the mains voltage using a permanent electrical connection. Place a double pole main switch with a contact opening of min. 3 mm between this permanent connection and the device. The power cable shall have a core of min. 3 x 1.0 mm².

Warning
Keep the device electrically isolated until you are ready to start it up.

1. Connect phase (L), zero (Z) and earth (⏚) of the power cable to the connector (C).
2. Mount the power cable into the strain relief (D).
3. Connect the power cable to the main switch.
4. Remount the cover plate.

3.10.4 Isolating transformer

An isolating transformer is used when a 'floating zero' is present. Consult the mounting instructions delivered with the isolating transformer (contact the supplier for the correct isolating transformer).

3.11 Check and adjust the CO_2-value

Remark
Fill the device before starting up the device and/or checking the CO_2-value (5 "Fill").

Caution
Checking the CO_2-value is obligatory when starting up the device for the first time.

Remark
You obviously need a CO_2-gauge for checking the CO_2-value.

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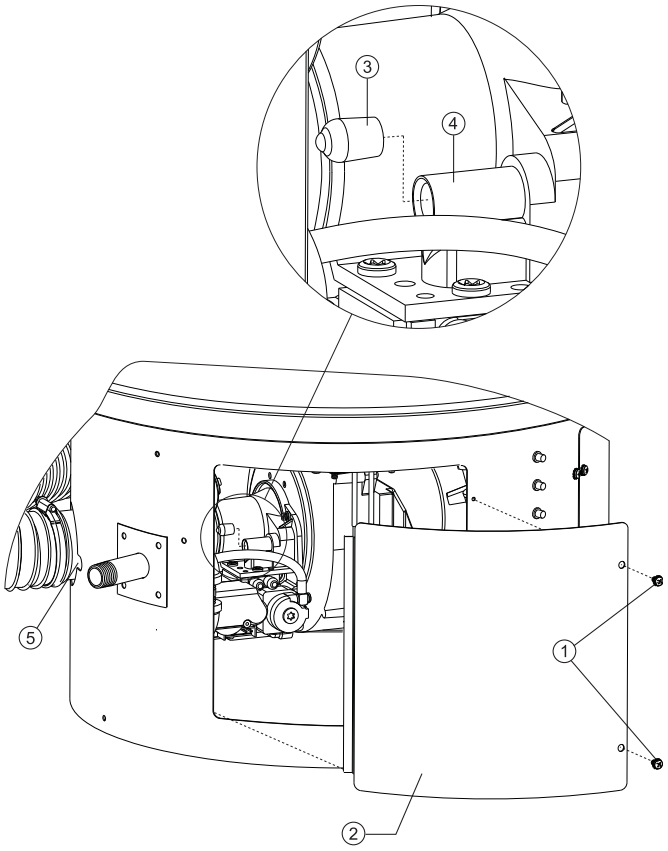
Gas control

Legends
Not mentioned numbers are not applicable.
1. screws
2. cover plate
3. sealing cap
4. CO_2 setting screw
5. setting hole



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3.11.1 Checking procedure

1. Position the probe of the CO_2-gauge into the flue gas discharge duct of the concentric venturi tube.
2. Open the gas supply and bleed the air from the gas system.
3. Switch on the voltage of the device using the main switch of the device.
4. Turn the thermostat clockwise until the device starts up.
5. After the red light is lit, wait for about 2 minutes before reading the CO_2-gauge.

If the CO_2-value does not correspond with the value given in the table (3.4.3 “gas data”), you can adjust the CO_2-value following the procedure (3.11.2 “Adjust the CO_2-value”).

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3.11.2 Adjust the CO_2-value

For preparation remove the cover plate (2) from the electricity part by loosening the two screws (1).

1. Remove the cap (3) from the CO_2 setting screw (4).
2. Insert a long screwdriver into the setting hole (5) along the air supply pipe.
3. Correct the CO2-value dependent on the deviation by turning the CO_2 setting screw (4).
   - CO_2 setting screw clockwise: CO_2-value decreases
   - CO_2 setting screw counterclockwise: CO_2-value increases
4. Put back the cap (3) on the CO2 setting screw (4).
5. Remount the cover plate (1).

Remark
Before starting up, take the time for completing the delivered warranty card. In this way you enable us to guarantee the quality of our systems and to optimise our warranty procedure.
Return this card as soon as possible. Your customer will then receive a warranty certificate with our terms of warranty.

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4 Conversion to another gas category

Conversion to another gas category is not possible.

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5 Fill

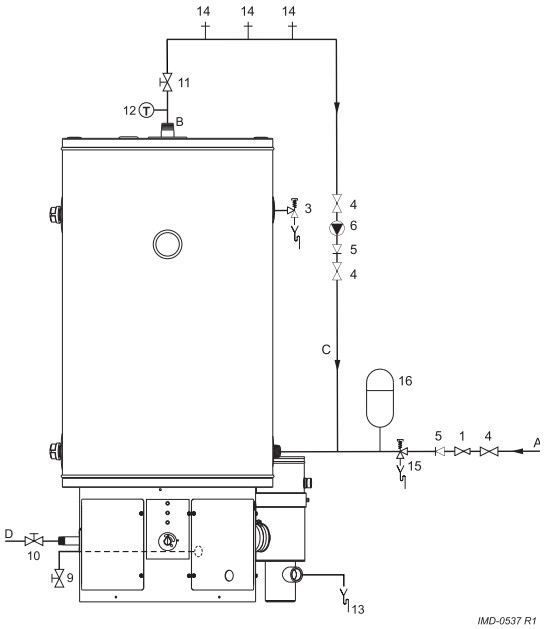
Legends
Not mentioned numbers are not applicable.

1. pressure reducing valve (obligatory)
3. T&P valve (obligatory)
4. stop valve (recommended in pipe C and obligatory in pipe A)
5. non-return valve (obligatory)
6. circulation pump (optional)
9. drain valve
10. manual gas valve (obligatory)
11. service valve
12. temperature meter (optional)
13. condensation drainage
14. draw-off points
15. expansion valve (obligatory)
16. expansion vessel (obligatory)
17. three-way aeration valve (recommended)
18. water tank
19. float valve

A. cold water supply
B. hot water discharge
C. circulation piping
D. gas supply
E. water overflow
H. overflow pipe

Connections diagram

UNVENTED



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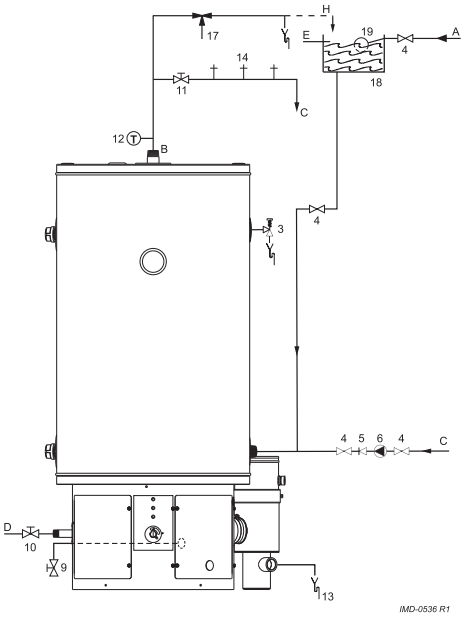

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5.1 Fill the device

5.1.1 Fill unvented installations

Proceed as follows for filling the device:

1. Open the stop valve (11) in the hot water pipe and (if present) the stop valves (4) of the circulation pump (6).
2. Close the drain valve (9).
3. Open the closest draw-off point (14).
4. Open the stop valve (4) on the cold water side (A), causing cold water to flow into the device.
5. Fill the device to the maximum. The device is full when the water flows out of the closest draw-off point in a forceful jet.
6. Bleed the entire installation, for example by opening all draw-off points.
7. The device will now be under water piping pressure. Water should not come out of the expansion valve (15) and out of the T&P valve (3) now. If so, it might be that:
   - The water piping pressure is larger than the required 8 bars. Mount a pressure reducing valve (1) after all.
   - The expansion valve of the protected cold supply setup is defective or incorrectly mounted.

5.1.2 Fill vented installations

Proceed as follows for filling the device:

1. Open the stop valve (11) in the hot water pipe and (if present) the stop valves (4) of the circulation pump (6).
2. Close the drain valve (9).
3. Open the closest draw-off point (14).
4. Open the stop valve (4) on the cold water side (A), causing cold water to flow into the device.
5. Fill the device to the maximum. The device is full when the water flows out of the closest draw-off point in a forceful jet.
6. Bleed the entire installation, for example by opening all draw-off points.
7. The device will now be under water piping pressure. Water should not come out of the T&P valve (3) now. If so, the T&P valve may be defective or have been mounted incorrectly.

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6 Drain

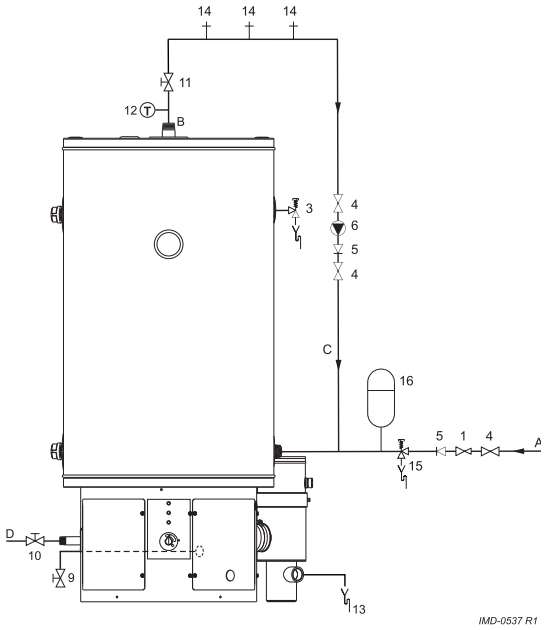
Legends
Not mentioned numbers are not applicable.

1. pressure reducing valve (obligatory)
3. T&P valve (obligatory)
4. stop valve (recommended in pipe C and obligatory in pipe A)
5. non-return valve (obligatory)
6. circulation pump (optional)
9. drain valve
10. manual gas valve (obligatory)
11. service valve
12. temperature meter (optional)
13. condensation drainage
14. draw-off points
15. expansion valve (obligatory)
16. expansion vessel (obligatory)
17. three-way aeration valve (recommended)
18. water tank
19. float valve

A. cold water supply
B. hot water discharge
C. circulation piping
D. gas supply
E. water overflow
H. overflow pipe

Connections diagram

UNVENTED



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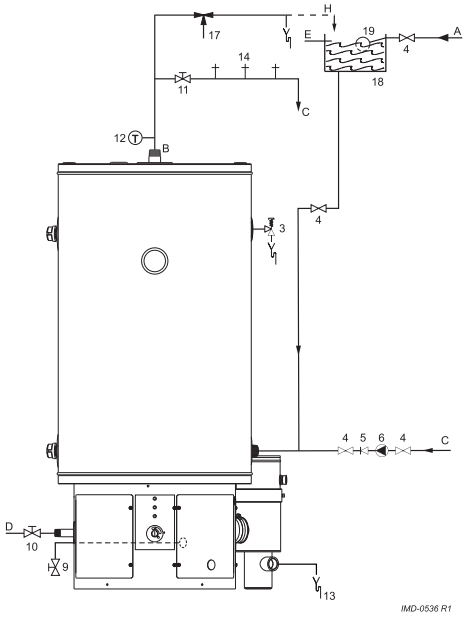

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6 Drain

6.1 Drain unvented installations

For some activities the device needs to be drained. Proceed as follows:

1. Electrically isolate the device by turning the main switch between the device and the electricity mains to the 0 position.
2. Shut off the gas supply (10).
3. Close the stop valve (11) in the hot water pipe.
4. Close the stop valve (4) in the cold water pipe (A).
5. Connect the discharge hose to the drain valve (9).
6. Open the drain valve (9).
7. Aerate the device (or installation) allowing it to completely empty.

6.2 Drain vented installations

For some activities the device needs to be drained. Proceed as follows:

1. Electrically isolate the device by turning the main switch between the device and the electricity mains to the 0 position.
2. Shut off the gas supply (10).
3. Close the stop valve (11) in the hot water pipe.
4. Close the stop valve (4) between de water tank and the cold water inlet (A).
5. Connect the discharge hose to the drain valve (9).
6. Open the drain valve (9).
7. Aerate the device (or installation) allowing it to completely empty.

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7 Start up

7.1 Introduction

This chapter will cover in the given order:
- Start up.
- Heating cycle of the device.

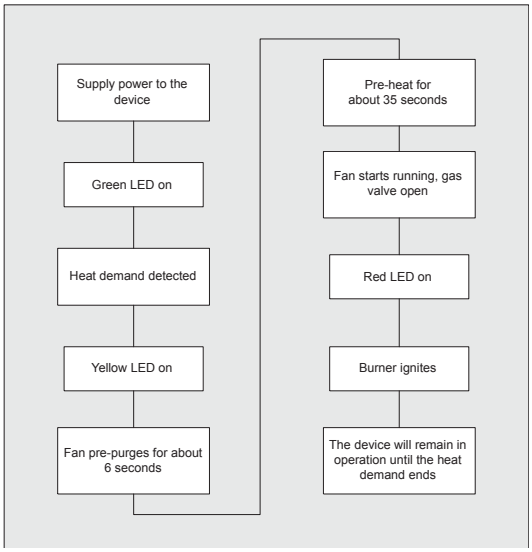
7.2 Start up

Start up the device by:
1. Filling the device (5 “Fill”).
2. Opening the gas valve (3.5 “Connections diagram”).
3. Switching on the voltage of the device using the main switch between the device and the electricity mains.
4. Setting the device to the desired temperature.

This device has been equipped with an electronic hot surface igniter that ignites the burner. There are three LEDs indicating the different operating conditions.
Green: the device is live.
Yellow: a heat demand has been detected; this indicates the beginning of the ignition cycle.
Red: the gas valve is open.

7.3 Heating cycle of the device

Heating cycle of the device


Supply power to the device
Green LED on
Heat demand detected
Yellow LED on
Fan pre-purges for about 6 seconds
Pre-heat for about 35 seconds
Fan starts running, gas valve open
Red LED on
Burner ignites
The device will remain in operation until the heat demand ends

As soon as there is a heat demand, the fan pre-purges for 6 seconds in order to remove any combustion gases still present. Then the fan stops and heats the hot surface igniter for 35 seconds. After this pre-heating period, the fan starts and the gas valve opens. This blows the air/gas mixture over the heated hot surface igniter and ignites the burner. The hot surface igniter switches off and subsequently works as a flame probe for measuring if the ignition has taken place. If the hot surface igniter detects loss of the flame, it will shut off the gas supply to the burner.

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The electronic control will then attempt to ignite the burner again three consecutive times. If this has not succeeded after three times, the electronic control will temporarily switch off. The control will automatically reset after an hour and the above-mentioned cycle will be repeated until a maximum of 9 ignition attempts. If the burner still has not been ignited, consult (9 “Errors”).

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8 Shut down

8.1 Introduction

You can:
- Shut down the device for a short time;
- Electrically isolate the device;
- Shut down the device for a long period.

8.2 Shut down the device for a short time

For shutting down the device for a short time, maximally turn the thermostat counterclockwise. This setting corresponds with a temperature of about 10 ºC, which protects the device from freezing.

8.3 Electrically isolate the device

1. Maximally turn the thermostat counterclockwise.
2. Wait until the fan stops.

Caution
The device may be damaged if you do not wait until the fan has stopped purging.

3. Electrically isolate the device by turning the main switch between the device and the electricity mains to the 0 position.

8.4 Shut down the device for a long period

Drain the device when shutting it down for a longer period. Proceed as follows:
1. Electrically isolate the device (8.3 “Electrically isolate the device”).
2. Close the gas supply.
3. Close the stop valve in the hot water pipe.
4. Close the supply valve of the protected cold supply setup.
5. Connect a discharge hose to the drain valve.
6. Open the drain valve
7. Aerate the device (or installation) allowing it to completely empty.

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8 Shut down

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9 Errors

9.1 Introduction

A distinction is made between:

- **General errors**

General errors are not visible on the control. General errors are:
- Gas smell
- Insufficient or no hot water
- Water leakage
- Explosive ignition.

The manual includes a table with general errors (9.2 “Troubleshooting table for general errors”).

- **Errors visible on the control**

The control displays errors by means of an indicator LED. This LED is visible through the inspection window in the cover plate of the control. Different errors are indicated by different flashing patterns of the LED.

The different errors are divided into three groups:

- SOFT LOCKOUT (SL)
  The control automatically resets after 60 minutes.

- SOFT LOCKOUT/HARD LOCKOUT (SL3)
  The control automatically resets after 60 minutes with a maximum of three attempts. If the burner still has not been ignited, contact the installation engineer.

- SELF CLEARING (SC)
  These errors disappear automatically if the cause of the error is no longer present. The device will automatically start up then.

The manual includes a table with Error messages that the control displays (9.3 “Troubleshooting table for errors visible on the control”). The electronic control can be reset by maximally turning the thermostat counterclockwise and returning it again to its original position.

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9.2 Troubleshooting table for general errors

Warning
Maintenance shall only be carried out by a service and maintenance engineer.

General errors

Symptom	Cause	Solution	Remark
Gas smell	Gas leakage	**Warning** Immediately close the mains gas supply valve. **Warning** Do not operate any switches. **Warning** No open fire! **Warning** Ventilate the area the device has been installed in.	**Warning** Immediately contact the installation engineer or the local gas company.
Water leakage	Leaking water connection (thread)	Tighten the threaded connection.	Contact the installation engineer if the leakage has not been remedied.
	Leakage of condensate	Check if condensate is discharged. Restore this if necessary.	
	Leakage from another water device or pipe nearby	Find the leakage.	
	Leakage of the tank of the device	Consult the supplier and/or the manufacturer.	
Explosive ignition	Incorrectly set CO_2-value	Set the correct CO_2-value (3.11 “Check and adjust the CO_2-value”)	Contact the installation engineer if the ignition has not improved.
	Contaminated burner	Clean the burner (10.4.2 “Clean the burner”).	

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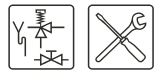

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Symptom	Cause	Solution	Remark
Insufficient or no hot water	The device is off	Start up the device (7 “Start up”).	Contact the installation engineer if the situation of insufficient or no hot water persists.
	Hot water supply is finished	Reduce the hot water consumption and give the device some time to heat up.	

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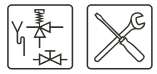
9.3 Troubleshooting table for errors visible on the control



Errors visible on the control

Light pulses	Cause	Solution	Remark
1 (SC) Air pressure switch closed	Defective air pressure switch	Replace the air pressure switch.	The error will automatically disappear when the air pressure switch opens again.
2 (SC) Air pressure switch is not functioning well	Break in the cable / Open circuit	1. Check the cabling between the air pressure switch and the control. 2. Replace the cabling if necessary.	Contact the installation engineer if the error cannot be remedied or if it reoccurs. Also contact the installation engineer for replacing the required parts.
	Air pressure switch does not close	1. Check if the fan is running 2. Check if the hoses are correctly mounted on the air pressure switch. 3. Check the hoses on the air pressure switch for cracks. Replace the hoses if necessary. 4. Check if the flue gas discharge is sufficient (3.8 “Air supply and flue gas discharge”). 5. Check for blockage of the air supply and the flue gas discharge. Remove any blockage. 6. Check for blockage of the condensation drainage. Remove any blockage. 7. Measure the pressure difference over the pressure switch. See the table in (10.2 “Prepare maintenance”). Clean the heat exchanger and burner in case of insufficient pressure difference. If the pressure difference is sufficient, check if the air pressure switch closes using a multimeter. 8. Check the supply voltage. This should be 230VAC (-15% +10%).	

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Pannes s'affichant sur la commande

Light pulses	Cause	Solution	Remark
3 (SL3) Three ignition attempts without success	No gas supply	1. Open the mains gas supply valve and/or the manual gas valve for the gas control. 2. Check the pre-pressure on the gas control. 3. If necessary, restore the gas supply.	Contact your installation engineer for restoring the gas supply.
	Air in the gas pipe	Bleed the gas pipe.	Contact your installation engineer for replacing the required parts.
	No gas supply to burner	1. Check if the gas valve switches. 2. Replace the gas control if necessary.	
	Error in the hot surface igniter circuit	1. Check if the hot surface igniter has been properly connected. See (12.2 "Electrical circuit diagram"). 2. Check the cabling of the hot surface igniter. 3. Check the voltage over the hot surface igniter. This should be 115 VAC. 4. Measure the resistance over the hot surface igniter. This should be between 45 and 400 Ohms. 5. Replace the hot surface igniter if necessary.	Contact the installation engineer in case of reoccurring errors. Contact the installation engineer for replacing the required parts.
	Phase and Zero incorrectly connected	Correctly connect the Phase and the Zero (3.9 "Electrical connection"). The device is phase-sensitive.	
	Error in the ionisation circuit	1. Check if the hot surface igniter has been properly connected. See (12.2 "Electrical circuit diagram"). 2. Check the cabling of the hot surface igniter. 3. Check if the ground wire of the burner has been properly connected. 4. Replace the hot surface igniter if necessary.	
	Supply voltage too low	Check the supply voltage. This should be 230VAC (-15% +10%).	

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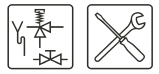

Pannes s'affichant sur la commande

Light pulses	Cause	Solution	Remark
4 (SL) Hardware error in gas control	Error in the gas control circuit	1. Check if the gas control has been properly connected. 2. Check the cabling of the gas control. 3. Replace the gas control if necessary.	Contact the installation engineer for replacing the required parts.
5 (SC) Hardware error in flame detection	Error in the ionisation circuit	1. Check if the hot surface igniter has been properly connected. 2. Check the cabling of the hot surface igniter. 3. Check if the ground wire of the burner has been properly connected. 4. Replace the hot surface igniter if necessary.	Contact the installation engineer for replacing the required parts.
6 (SL) Flame detected with closed gas valve	Contact with metal surface because of break in the cable	1. Check the cabling of the hot surface igniter. 2. Replace the cabling if necessary.	The electronic control automatically resets after ionisation signal dissappears. Contact the installation engineer in case of reoccurring errors. Contact the installation engineer for replacing the required parts.
	Defective gas valve	1. Check for presence of burner pressure when the gas valves are closed. 2. Check if a flame is still present when the gas valves are closed. 3. If so, replace the gas control.	
	Defective control	1. Reset the electronic control. 2. Replace the electronic control if the error reoccurs.	
8 (SL) Hardware error in the electronic control	Defective control	1. Reset the electronic control. 2. Replace the electronic control if the error reoccurs.	Contact your installation engineer for replacing the required parts.
9 (SL) Software error in the electronic control	Defective control	1. Reset the electronic control. 2. Replace the electronic control if the error reoccurs.	Contact your installation engineer for replacing the required parts.

10 Maintenance

10.1 Introduction

Service shall be carried out at least once a year both on the gas side and on the water side. The frequency of the maintenance depends, among other things, on the water quality, the average number of operating hours per day and the set water temperature.

Remark

Regular maintenance lengthens the life of the device. For determining the correct maintenance frequency, it is advised to have the service and maintenance engineer check the gas side and the water side of the device three months after installation. The maintenance frequency can be determined on the basis of this check.

10.2 Prepare maintenance

Proceed as follows for testing the proper functioning of all components:

1. Maximally turn the thermostat counterclockwise.
2. Wait until the fan stops.
3. Turn the thermostat to its original position. Then draw off water to create a heat demand.
4. Check if the heating cycle runs correctly (7.3 “Heating cycle of the device”).
5. Check the CO_2-value and adjust this if necessary (3.11 “Check and adjust the CO_2-value”).
6. Check all parts of the flue gas discharge system for proper fastening.
7. Check the pressure difference of the pressure switch (see the table). Clean the heat exchanger and burner if the pressure difference is too low (10.4.2 “Clean the burner” AND 10.4.3 “Clean heat exchanger”).

Pressure difference of air pressure switch

Device	Measured pressure difference over air pressure switch
TWI 35-130	≥ 730 Pa
TWI 45-190	≥ 400 Pa

8. Test the functioning of the expansion valve of the protected cold supply setup. The water has to flow out in a forceful jet.
9. Test the functioning of the T&P valve (if applicable). The water has to flow out in a forceful jet.
10. Check the discharge pipes of the expansion valve and remove any present scale deposits.
11. Drain the device (see Drain).

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10.3 Water-side maintenance

10.3.1 Descale

Scaling depends on the water condition and the water demand. Besides, more scale deposit will be formed in the device at high temperatures. A temperature setting of 60 ºC is recommended to ensure low scale deposit. Descale using the appropriate agents. A descaling instruction is available for detailed information.

10.3.2 Clean the condensation drainage

Regularly clean the condensation drainage and the siphon to avoid stoppage.

10.4 Gas-side maintenance

10.4.1 Introduction

Proceed as follows for gas-side maintenance:

1. Clean the burner.
2. Clean the heat exchanger.

10.4.2 Clean the burner

1. Dismount the burner.
2. Remove the contamination present on the burner.
3. Remount the burner.

10.4.3 Clean the heat exchanger

1. Dismount the burner.
2. Clean the combustion chamber of the heat exchanger using a vacuum cleaner and a soft brush.
3. Dismount the flue gas discharge.
4. Clean the end of the heat exchanger using tap water.
5. Remount the burner.
6. Remount the flue gas discharge.

Remark

Check the pressure difference again after cleaning. Contact the supplier of the device if the pressure difference remains too low.

10.5 Complete maintenance

Proceed as follows for completing the maintenance:

1. Fill the device (5 “Fill”).
2. Start up the device (7 “Start up”).

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11 Warranty (certificate)

In order to register your warranty, please fill in the enclosed warranty card and return this to us. We will then send you a warranty certificate. This certificate will entitle the owner to warranty as described below for a boiler delivered by A.O. Smith Water Products Company B.V. in Veldhoven, that will be committed towards the owner with respect to this.

11.1 Warranty general

If, within one year from the original installation date, after investigation and exclusive evaluation by A.O. Smith, a boiler delivered by A.O. Smith turns out to have a part, with the exception of the tank, that is not properly functioning as a result of manufacturing or material faults, A.O. Smith will replace or repair this part.

11.2 Warranty tank

If, within five years from the original installation date, after investigation and exclusive evaluation by A.O. Smith, a boiler delivered by A.O. Smith turns out to have a stainless steel tank that is leaking as a result of rust or corrosion from the water side, A.O. Smith will replace the entire boiler by a brand new one of similar size and quality. The replacement boiler will have a warranty that will be valid for the remaining period of the warranty for the original boiler delivered. Notwithstanding the provisions in Article 2, the warranty term will be reduced to one year after the original installation date if unfiltered or softened water is flowing through the boiler or left in it.

11.3 Conditions of installation and use

The warranty referred to in Articles 1 and 2 only apply if the following conditions are met:

a. The boiler is installed according to the installation instructions of A.O. Smith for the specific model as well as according to the local and national installation and building regulations, instructions and rules.
b. The boiler will remain installed in the original installation area.
c. Only drinking water is used, which is allowed to circulate freely at all times (a separately installed heat exchanger is obligatory for heating saline or corrosive water).
d. The tank has been protected against harmful scale deposits by means of periodic maintenance.
e. The boiler-water temperatures do not exceed the maximum setting of the thermostats that are part of the boiler.
f. The water pressure and/or heat load do not exceed the maximum values indicated on the boiler's identification plate.
g. The boiler has not been installed in a corrosive atmosphere or environment.
h. The boiler has been provided with a by an authorised body approved protected cold supply setup of sufficient capacity not greater than the operating pressure indicated on the boiler and, if applicable, with a temperature and pressure relief valve, also approved by an authorised body, which has been mounted according to the installation instructions of A.O. Smith applicable to the specific boiler model as well as according to the local and national instructions, regulations and rules.

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11.4 Exclusions

The warranty referred to in Articles 1 and 2 does not apply:

a. if the boiler has been damaged by an external cause;
b. in case of abuse, neglect (including freezing), modification, incorrect and/or deviating use of the boiler and if attempts were made to repair leaks;
c. if contamination or other impurities were allowed to flow into the tank;
d. if the conductivity of the water is less than 125 mS and/or the hardness (alkaline earth ions) of the water is less than 1.00 mmol/l (3.3.3 Water composition");
e. if unfiltered, recirculated water flows through or is stored in the boiler;
f. if the owner has attempted to repair a defective boiler himself.

11.5 Extent of the warranty

A.O. Smith's commitments pursuant to the warranty provided are confined to the free of charge ex-warehouse delivery of the boiler to be replaced or any parts thereof. A.O. Smith shall not bear the transport, labour, installation and other costs in connection with the replacement.

11.6 Claims

A claim based on the warranty provided shall be deposited with the dealer from whom the boiler was purchased or any other dealer who sells products manufactured by A.O. Smith. The investigation of the boiler as referred to in the Articles 1 and 2 will take place in an A.O. Smith laboratory.

11.7 Obligations of A.O. Smith

Concerning its boilers or any boiler replacement part supplied, respectively, A.O. Smith will not provide any warranty or guarantee other than the warranty explicitly stated in this certificate.

A.O. Smith shall not accept any liability pursuant to the warranty or otherwise for any injuries to persons or damage to materials caused by a boiler or replacement boiler or any part thereof or the stainless steel tank thereof, respectively, supplied by A.O. Smith.

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12 Annex

12.1 Introduction

This annex contains:

- The Electrical circuit diagram.
- Legends

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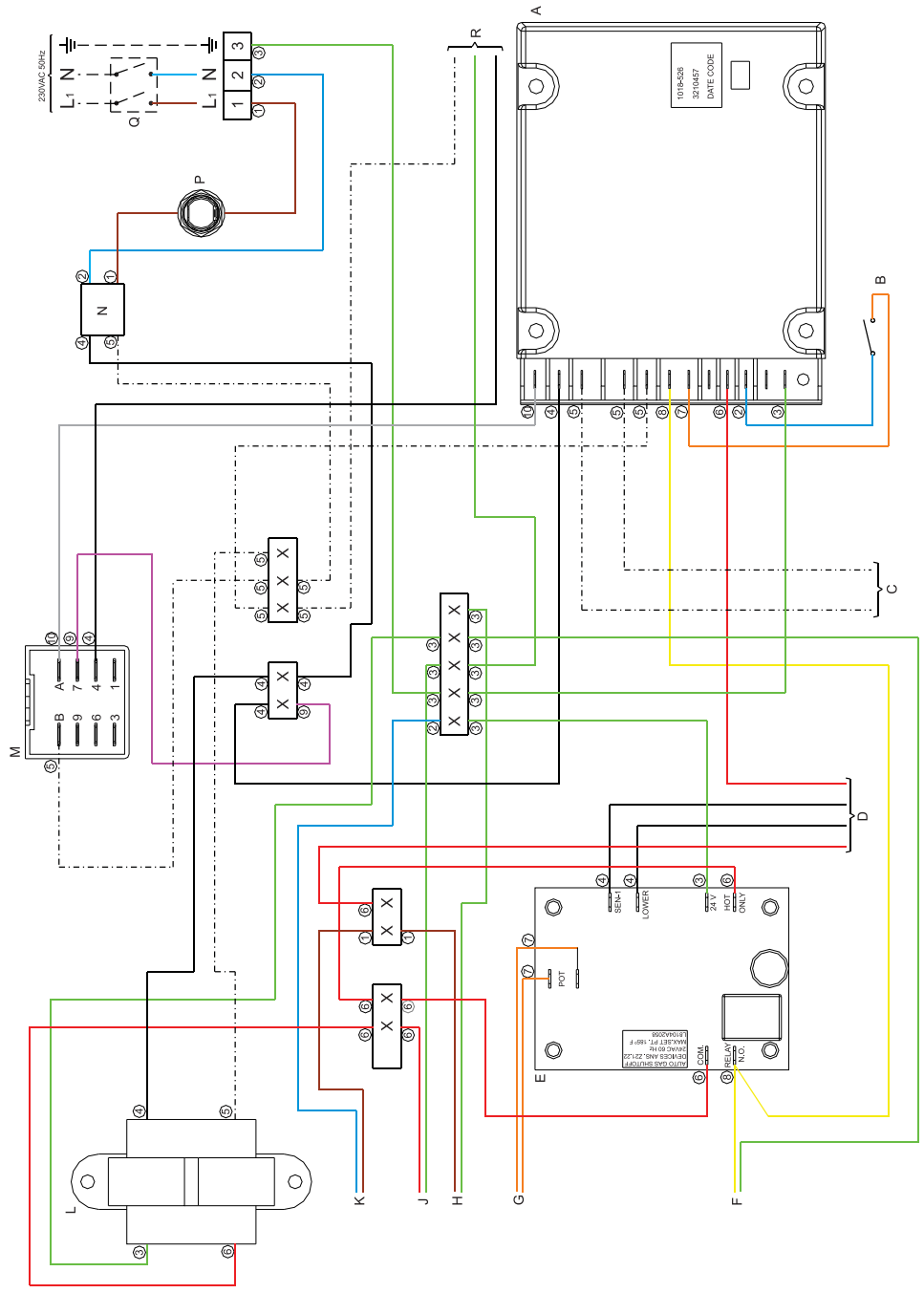
12.2 Electrical circuit diagram



IMD 0380 429 R0

1 = brown, 2 = blue, 3 = green, 4 = black, 5 = white, 6 = grey / beige

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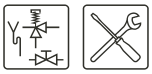

12.3 Legends

WIRING

(1) = brown
(2) = blue
(3) = green
(4) = black
(5) = white
(6) = red
(7) = orange
(8) = yellow
(9) = black/red
(10) = black/white

CLAMPING STRIP CONNECTIONS:

⏚ Earth
N Zero
L_1 Phase

COMPONENTS:

A Electronic control
B Air pressure switch
C Hot surface igniter
D Temperature sensor / ECO
E Thermostat board
F Yellow LED
G Thermostat
H Red LED
J Green LED
K Gas control
L Transformer 120 VAC-24 VAC
M Fan isolating relay
Z Transformer 230 VAC-120 VAC
P Fuse
O Double-pole main switch
R Fan

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